Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Review of the Commission's Rules Governing the 896-901/935-940 MHz Band	)	WT Docket No. 17-200
	)	
	)	
Realignment of the 896-901/935-940 MHz Band to Create a Private Enterprise Broadband Allocation	)	RM-11738 (Terminated)
	)	
	)	
Amendment of the Commission's Rules to Allow for Specialized Mobile Radio Services Over 900 MHz Business/Industrial Land Transportation Frequencies	)	RM-11755 (Terminated)

REPLY COMMENTS OF SENSUS USA INC.

David Alban
Associate General Counsel
Xylem Inc.
639 Davis Drive
Morrisville, NC 27560
(919) 845-4010

Counsel for Sensus USA Inc.

November 1, 2017

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EXECUTIVE SUMMARY

The comments filed on the *Notice of Inquiry* ("*NOI*") by Sensus USA Inc. ("Sensus") and others reaffirm that users of the narrowband PCS ("NPCS") spectrum at 901-902/940-941 MHz (the "NPCS band") have significant concerns about adjacent channel interference from broadband operations in the 896-901/935-940 MHz ("900 MHz") band. Commenting parties are particularly concerned about the 900 MHz rebanding proposal put forth by the Enterprise Wireless Alliance and pdvWireless, Inc. (collectively, "PDV"), which would put 900 MHz broadband operations immediately adjacent to the NPCS band. At the same time, the technical information filed with PDV's comments and the comments of Pericle Communications Company ("Pericle") does little to address the interference problem. PDV's technical showing in support of its proposal remains highly flawed and, after three years, is unsubstantiated by any equipment testing.

PDV is wrong when it suggests that NPCS licensees have no right to object to any increase in the noise floor within the NPCS band that would be caused by adjacent channel broadband operations. PDV's argument ignores the fact that, as a matter of engineering practice, NPCS users designed their systems based on the interference environment that actually existed at the time, and not based on some hypothetical worst case scenario that may or may not come to fruition. Second, NPCS user reliance on the quieter noise floor in the NPCS band was reasonable given the long history of low out of band emissions from narrowband systems in the 900 MHz band.

Any further Commission action in this matter must give NPCS users assurance that they will be protected from adjacent channel interference. That is, consistent with the comments of Motorola, NPCS licensees should not be subject to diminished performance, coverage or capacity in order to accommodate new broadband deployment. To that end, the Commission should at a minimum consider imposing a guard band between 900 MHz broadband operations and NPCS users, as it has already done to minimize interference between broadband and narrowband operations in the 700 MHz public safety spectrum. Sensus likewise agrees that all costs incurred for any required modifications of NPCS systems should be fully funded by 900 MHz broadband operations that are causing adjacent channel interference.

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REPLY COMMENTS OF SENSUS USA INC.

Sensus USA Inc. ("Sensus") respectfully submits these reply comments in response to the Commission's Notice of Inquiry ("*NOI*") in the above-referenced proceeding.[1]

I. INTRODUCTION

In its comments on the *NOI*, Sensus urged the Commission not to move forward, or to at least proceed cautiously, on any proposals in the instant proceeding to permit broadband operations in the 896-901/935-940 MHz ("900 MHz") band.[2] Broadband operations at 900 MHz would pose a risk of harmful interference to critical infrastructure industry ("CII") operations in the adjacent narrowband PCS ("NPCS") spectrum at 901-902/940-941 MHz (the "NPCS

[1] *Review of the Commission's Rules Governing the 896-901/935-940 MHz Band*, Notice of Inquiry, 32 FCC Rcd 6421 (2017). Sensus notes that it continues to engage in dialogue and exchange information with PDV, both as to concerns and potential solutions, that may enable it to reach agreement on or narrow certain issues raised in its comments on the *NOI*.

[2] *See* Comments of Sensus USA Inc., WT Docket No. 17-200, at 2 (filed Oct. 2, 2017) ("Sensus Comments").

band").[3] This is evident from the proposal of the Enterprise Wireless Alliance ("EWA") and pdvWireless, Inc. (the "PDV Proposal") to create a "3 x 3" private enterprise broadband ("PEBB") allocation at 898-901/937-940 MHz and a "2 x 2" narrowband allocation at 896-898/935-937 MHz, which would put 900 MHz broadband operations in spectrum immediately adjacent to the NPCS band.[4] Sensus resubmitted or cross-referenced its prior technical studies and other filings which demonstrated that the PDV Proposal was deeply flawed and would result in harmful interference to NPCS operations.[5]

Other comments on the *NOI* echo Sensus's concerns – as noted by the Edison Electric Institute ("EEI"), "[t]here is a limited public interest benefit to the rebanding proposals in the *NOI*, but tremendous risk."[6] Moreover, while some have filed comments supporting the PDV Proposal or the concept of rebanding the 900 MHz band generally, those parties by and large have ignored the serious adjacent channel interference problem identified in Sensus's prior studies and other filings. Ultimately, regardless of whether the Commission proposes to permit

[3] Sensus has developed an innovative and distinctive network communications technology called FlexNet that operates in the NPCS band to provide utilities with secure and reliable connectivity solutions supporting multiple applications, including, for example, advanced metering infrastructure ("AMI"), distribution automation and monitoring, demand response, and equipment monitoring and control. *Id.* at 3. Presently, Sensus has approximately 1,200 customers that operate FlexNet systems in the NPCS band, most of which are electric, natural gas and water distribution utilities. There are more than 15 million FlexNet endpoints operating on NPCS channels throughout the continental United States. Accordingly, Sensus and its FlexNet customers would be directly affected by broadband operations in the adjacent 900 MHz band. *Id.* at 4.

[4] *See NOI*, 32 FCC Rcd at 6425-7 ¶¶ 12-14 (discussing PDV Proposal).

[5] Sensus Comments at 2 n.3 and Attachment 1.

[6] Comments of Edison Electric Institute, WT Docket No. 17-200, at 16 (filed Oct. 2, 2017) ("EEI Comments").

900 MHz broadband operations via a 3 x 3 broadband segment,[7] a 5 x 5 broadband segment,[8] or greater operational flexibility under the existing 900 MHz licensing framework,[9] the underlying technical issue remains the same: broadband operations at 900 MHz will cause harmful interference to adjacent channel NPCS operations unless the Commission's technical rules protect NPCS users.

The additional technical information submitted jointly by EWA and pdvWireless, Inc. (collectively, "PDV"), [10] supplemented by a white paper separately filed by Pericle Communications Company,[11] adds little new to the record. As discussed in the response attached hereto from Sensus's technical consultant, Real Wireless, Ltd. (see Attachment 1), PDV continues to rely on incorrect or overly optimistic assumptions when calculating out of band emissions, and understates the cumulative effect those emissions will have on adjacent channel NPCS operations.

Should the Commission nevertheless proceed to a rulemaking on facilitating broadband operations at 900 MHz (whether through the PDV Proposal or some other mechanism), it must ensure that any technical rules protect adjacent NPCS users and fully compensate them for any system modification costs incurred to avoid adjacent channel interference. To mitigate that interference, the Commission should consider imposing a guard band between broadband 900

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[7] *NOI*, 32 FCC Rcd at 6430 ¶ 27.

[8] *Id.* at 6430 ¶ 28.

[9] *Id.* at 6428-30 ¶¶ 19-25.

[10] *See* Comments of Enterprise Wireless Alliance and pdvWireless, Inc., WT Docket No. 17-200, Attachment 2 (filed Oct. 2, 2017) ("PDV Comments").

[11] *See* Comments of Pericle Communications Company, WT Docket No. 17-200, Attachment 1 (filed Oct. 2, 2017).

MHz and NPCS operations, similar to what it has done in the 700 MHz public safety spectrum. Lastly, the Commission should require PDV to conduct rigorous "real world" testing of its proposal to demonstrate the actual amount of adjacent channel interference NPCS users will suffer, rather than rely on misguided assumptions and calculations about what that interference might be.

II. THE COMMENTS FILED ON THE NOI REAFFIRM THAT BROADBAND OPERATIONS AT 900 MHZ RAISE SUBSTANTIAL INTERFERENCE CONCERNS.

Commenting parties continue to express serious concerns about adjacent channel interference that would result from the PDV Proposal. For instance, Southern Company Services, Inc. ("Southern Company"), a major user of Sensus's FlexNet technology in the NPCS band, states that "[t]he band plan initially proposed by EWA and PDV would pose the highest risk of interference to licensees in the adjacent NPCS band, as it would put the proposed new broadband operations right up against the NPCS band with effectively no guard band or other separation between these two services."[12] Further, "[u]nwanted emissions, whether from adjacent channel operations or otherwise, that result in increased interference could seriously degrade, obstruct or disrupt Southern's AMI system. . . [A]n additional 5 dB of interference could have a significant adverse impact on Southern's AMI system."[13]

The Critical Infrastructure Coalition ("CIC") likewise reaffirms that "[t]he record in the PDV proceeding [RM-11738]. . . demonstrates that broadband operations risk harmful

[12] Comments of Southern Company Services, Inc., WT Docket No. 17-200, at 11 (filed Oct. 2, 2017) ("Southern Company Comments"). *See also* Comments of Exelon Corporation, WT Docket No. 17-200, at 3 (filed Oct. 2, 2017) ("[I]ncumbent users in the 900 MHz band and adjacent bands rely on this spectrum for critical communications and reconfiguring the band to introduce broadband operations would likely result in harmful interference to these incumbents.") ("Exelon Comments").

[13] Southern Company Comments at 7.

interference to narrowband operations adjacent to the 900 MHz band."[14] The Sensus Partners and Advisors Network ("SPAN"), a network of electric, gas and water utilities that use FlexNet in the NPCS band, observes that that the potential interference resulting from implementation of the PDV Proposal would be "devastating."[15] And, NPCS users are utilities that provide CII services, and thus disruption of their operations by adjacent channel interference would bear directly on public safety.[16] As Exelon Corporation points out, "[t]he nature of electric and gas utilities' communications requires the highest level of protection from interference possible, to ensure reliability of [their] required operations. Such utilities are considered critical infrastructure industry entities, and as such, require reliable communication based monitoring and control for their distribution grid and associated systems."[17]

Commenting parties also remain concerned about the interference ramifications of putting broadband operations adjacent to narrowband operations within the 900 MHz band. EEI states that "[e]xacerbated by the lack of guard bands, the magnitude of harmful, wideband

[14] Comments of Critical Infrastructure Coalition, WT Docket No. 17-200, at 10 (filed Oct. 2, 2017) ("CIC Comments").

[15] Comments of Sensus Partners and Advisors Network, WT Docket No. 17-200, at 4 (filed Oct. 2, 2017) ("SPAN Comments"). *See also* EEI Comments at 15 (filed Oct. 2, 2017) ("AMI systems deployed in the narrowband PCS band immediately adjacent to the 900 MHz band are particularly vulnerable to interference from 3/3 MHz broadband operations.").

[16] SPAN Comments at 5; CIC Comments at 3 ("Incumbent users in the 900 MHz and adjacent bands use the spectrum for a wide range of mission-essential communications, including disaster recovery efforts, electrical and water service maintenance and restoration, nuclear power plant operations and security, public safety and smart grid applications.").

[17] Exelon Comments at 3-4. *See also* Southern Company Comments at 7 ("Southern's experience demonstrates that an effective AMI system is a critical component of the modern energy grid. Current and future uses of AMI data and functionalities continue to expand, and any disruption of AMI services due to interference, now or in the future, will significantly hamper the ability of Southern and other utilities to continue to provide electric and gas service to the public on a safe, reliable, and efficient basis.").

interference that the proposed 3/3 MHz broadband operations would create would completely eliminate the ability of many existing electric company PLMR 900 MHz systems to continue operations."[18] Westar Energy, Inc. asserts that "[c]oncentrating all B/ILT licensees in 2 x 2 spectrum would result in closer frequency spacing and a greater chance of interference . . . The end result could be reduced coverage area and the inability to communicate in certain areas."[19] NextEra Energy, Inc. notes that "placing the broadband segment next to a compressed narrowband segment for B/ILT communications . . . would increase the likelihood of interference. Those interference concerns will be present whether the Commission pursues realignment of the band as proposed by EWA/PDV, through voluntary realignment on a market-by-market basis or by granting increased operational flexibility that would allow broadband operations in the 900 MHz band."[20]

Almost without exception, those who support the PDV Proposal or the general concept of a 3 x 3/2 x2 band realignment do not address interference issues to any significant extent. A Beep, LLC, for example, states that "relocation could be done with . . . minimal interruption," overlooking the fact users of the NPCS band cannot be relocated to other spectrum.[21] General Dynamics Mission System does not discuss interference consequences in the NPCS band, [22] nor,

[18] EEI Comments at 14.

[19] Comments of Westar Energy, Inc., WT Docket No. 17-200, at 5 (filed Oct. 2, 2017).

[20] Comments of NextEra Energy, Inc., WT Docket No. 17-200, at 3 (filed Oct. 2, 2017).

[21] Comments of A Beep, LLC, WT Docket No. 17-200, at 1 (filed Oct. 2, 2017).

[22] Comments of General Dynamics Mission Systems, WT Docket No. 17-200 (filed Sept. 18, 2017).

for example, does Puloli, Inc., Comtronics Corporation or Teleworld Solutions.[23] On the other hand, Motorola, while supporting the PDV Proposal, makes it clear that "narrowband licensees should not be subject to diminished performance, coverage or capacity in order to accommodate new broadband deployment."[24] If Motorola intended to include NPCS users within the ambit of "narrowband licensees," then Sensus endorses Motorola's statement.

In sum, the record confirms that the Commission should tread carefully when evaluating the merits of the PDV Proposal or any other proposal that would put 900 MHz broadband operations adjacent to the NPCS band. The interference consequences are real and potentially serious – addressing the problem after the fact is not a feasible option.

III. PDV'S ADDITIONAL TECHNICAL INFORMATION DOES NOT ELIMINATE THE FLAWS IN THE PDV PROPOSAL.

The PDV Proposal was previously considered in RM-11738, which the Commission has now terminated. In its comments on the *NOI*, Sensus resubmitted or cross-referenced its substantial technical showings and other filings in RM-11738. Those submissions demonstrated the significant coexistence challenges that would result from putting prospective 900 MHz broadband operations in spectrum adjacent to the NPCS band, as proposed by PDV.[25] Sensus also reemphasized that many of the assumptions underlying PDV's technical analysis were either unrealistic or unsupportable, and that among other things the PDV Proposal significantly understated out of band emissions ("OOBE"), misstated the noise floor at which FlexNet systems

[23] Comments of Puloli, Inc., WT Docket No. 17-200 (filed Oct. 2, 2017); Comments of Comtronics Corporation, WT Docket No. 17-200 (filed Sept. 21, 2017); Comments of Teleworld Solutions, WT Docket No. 17-200 (filed Oct. 2, 2017).

[24] Comments of Motorola, WT Docket No. 17-200, at 4 (filed Oct. 2, 2017) ("Motorola Comments").

[25] Sensus Comments at 2 n.3 and Attachment 1.

operate, and in many cases used inappropriate calculation parameters that produced inaccurate results.[26]

PDV has now submitted additional technical information with its comments on the *NOI*, in the form of a report from its technical consultant, DVA Consulting, LLC ("DVA").[27] In addition, PDV relies on a white paper Pericle has submitted with its comments on the *NOI*.[28] Based on these filings, PDV "believe[s] that there is an extremely low risk of harmful interference to adjacent LMR or Narrowband PCS systems operating at 901-902/940-941 MHz ("NPCS") irrespective of their receiver specifications."[29]

Sensus's technical consultant, Real Wireless, Ltd. ("Real Wireless"), has reviewed the DVA and Pericle studies. As discussed in its report attached hereto as Attachment 1, Real Wireless has concluded that the DVA and Pericle studies add little new to the record, and thus do not adequately address Sensus's concerns about adjacent channel interference. For example:

- As with PDV's prior technical showings, the technical parameters in DVA's analysis are grounded in overly optimistic or otherwise unrealistic assumptions. DVA's analysis also relies on references that are not appropriate for the situation being examined here, *i.e.*, broadband signals being transmitted on frequencies adjacent to sensitive long range AMI systems that operate in quiet spectrum.[30] The Pericle study suffers from similar flaws.[31]

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[26] *Id.* at 5.

[27] *See* PDV Comments, Attachment 2.

[28] *See* Pericle Comments, Attachment 1 (filed Oct. 2, 2017).

[29] PDV Comments at 32.

[30] See Attachment 1 hereto at 9.

[31] For example, the Pericle white paper compares the PDV Proposal to the 800 MHz band realignment, and states that interference from a single LTE carrier with no guard band (the PDV Proposal) is no worse than the interference 800 MHz public safety users suffer from two broadband carriers with a 2 MHz guard band (the 800 MHz situation). Pericle Comments, Attachment 1 at 5. Real Wireless questions the analogy of 800 MHz public safety systems to Sensus's AMI systems, which are long range systems designed to different performance

- The measures proposed in the DVA and Pericle studies to mitigate out of band emissions only partially address the additional filtering requirements Real Wireless recommended in Sensus's prior filings, Sensus's AMI systems remain at high risk of interference from 900 MHz broadband operations unless the PDV Proposal satisfies *all* of those requirements.[32]

The Commission also should reject PDV's suggestion that NPCS licensees have no right to object to any increase in the noise floor within the NPCS band caused by adjacent channel broadband operations. PDV's argument is that "[r]esponsible licensees purchase equipment and design their systems to operate reliably, based on the technical rules that define permissible co-channel and adjacent channel operations; that is, to function in the wireless environment permitted by those rules, rather than in reliance on an under-utilization of spectrum or a non-existent 'right' to no increase in the noise floor over time."[33] This argument is wrong for at least two reasons.

First, as a matter of engineering practice, "responsible licensees" design their systems based on the interference environment that exists at the time, not based on some hypothetical worst case scenario that may or may not come to fruition. Second, FlexNet users' reliance on the quieter noise floor in the NPCS band was reasonable given the history of the 900 MHz band. This issue is discussed at length in Sensus's June 29, 2015 comments in RM-17338 on the PDV Proposal (which were attached to Sensus's comments on the *NOI*) and need not be repeated in

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parameters. *See* Attachment 1 hereto at 10. Likewise, Real Wireless questions Pericle's suggestion that interference conclusions for Part 90 users within the 900 MHz band may apply equally to Part 24 NPCS operations. Part 90 and Part 24 facilities are entirely different systems that, once again, use different design parameters. Pericle Comments, Attachment 1 at 9; *see also* Attachment 1 hereto at 10.

[32] *See* Attachment 1 hereto at 15.

[33] PDV Comments at 31.

detail here.[34] Briefly, (1) the 900 MHz band was heavily used for many years by Sprint's iDEN network, and was not available to other types of narrowband licensees; (2) iDEN handheld units had very low out of band emissions – in fact, due to the economics and technical requirements of iDEN systems, iDEN handheld units used emission masks that far and away were more stringent than those required under the Commission's rules; (3) iDEN was commercially successful and reasonably appeared set to continue to dominate the 900 MHz band; and (4) even if other types of narrowband licensees had used the 900 MHz band instead of iDEN, a material increase in out of band emissions would have been unlikely due to the technical requirements of narrowband land mobile systems, which virtually compel the licensee to take extra measures to limit out of band emissions and thereby minimize intra-system interference.

IV. TECHNICAL RULES FOR 900 MHZ BROADBAND OPERATIONS MUST ENSURE THAT NPCS OPERATIONS ARE FULLY PROTECTED.

Any further Commission action in this matter must give NPCS users assurance that they will be protected from adjacent channel interference. As discussed above, Sensus agrees with Motorola that narrowband licensees should not be subject to diminished performance, coverage or capacity in order to accommodate new broadband deployment. To that end, the Commission should at a minimum consider imposing a guard band between 900 MHz broadband operations and NPCS users, as it has already done to minimize interference between broadband and narrowband operations in the 700 MHz public safety spectrum.[35] Also, Sensus agrees that all

[34] *See* Sensus Comments, Attachment 1 at 19-23.

[35] *Implementing Public Safety Broadband Provisions of the Middle Class Tax Relief and Job Creation Act of 2012*, Second Report and Order, 28 FCC Rcd 15174, 15185-6 ¶¶ 36-40 (2013).

costs of any required NPCS system modifications should be fully funded by the 900 MHz broadband operators who are causing adjacent channel interference.[36]

Finally, it should be noted that the PDV Proposal has now been pending for three years. PDV thus has had ample time to prove its conclusions about non-interference through equipment testing. It has not done so, and instead continues to base its technical analysis on theoretical assumptions that, as Sensus has shown, are flawed at best. The Commission should not move forward on the PDV Proposal until PDV fills this hole in the record.

V. CONCLUSION.

For the foregoing reasons, Sensus repeats its request that the Commission not move forward, or least proceed cautiously, with any proposals to permit broadband operations in the 900 MHz band. Sensus further requests that any further Commission action in this proceeding be taken in a manner consistent with these reply comments and Sensus's initial comments on the *NOI.*

Respectfully submitted,

SENSUS USA INC.

/s/ David Alban

David Alban
Associate General Counsel
Xylem Inc.
639 Davis Drive
Morrisville, NC 27560
(919) 845-4010

Counsel for Sensus USA Inc.

November 1, 2017

[36] *Compare* Motorola Comments at 4.

ATTACHMENT 1

realwireless.

independent wireless experts

High Level Review of Consultant Reports filed by Enterprise Wireless Alliance and PDV Wireless Inc. in WT Docket No. 17-200

Covering reports from DVA Consulting LLC and Pericle Communications Company

SENSUS

a xylem brand

Version	Date	Owner	Comments
V0.8	30/10/2017	RW	Updated by Real Wireless

Contents

Background

- Real Wireless has been engaged by Sensus since 2015 to advise on the plans put forward by the Enterprise Wireless Alliance and pdvWireless in their FCC Petition for Rulemaking filed November 17 2014 to deploy broadband LTE like systems (called PEBB) in spectrum close to that used by Sensus and its customers for Advanced Metering Infrastructure (Smart Metering) raising the question of significant interference to and performance degradation of such AMI systems
- The critical review undertaken by Real Wireless at that time using data from PDV concluded that the technical parameters chosen by PDV to demonstrate that there would be few co-existence challenges were very optimistic and did not relate to the 'real world' situation that Sensus operated in or to practical deployment scenarios
- The critical review was included as Exhibit 1 to comments submitted by Sensus to the Petition of Rulemaking on 29 June 2015
- Beyond the critical review Real Wireless has also used data from deployed Sensus Smart Metering systems to identify the quantum of disruption that the PEBB system was likely to cause under various conditions – identifying significant percentages of meters that could lose the wireless connection to all Sensus base stations under various scenarios i.e. the meter would be out of service
- Sensus has asked Real Wireless to review the Consultant reports included in the EWA/PDV submissions to the FCC as part of WT Docket No. 17-200 following the FCC's announcement of a Notice of Inquiry
- The Consultant reports being commented on in this document are those from DVA Consulting LLC dated December 7 2015 and Pericle Communications Company dated September 29 2017

Comments on report from DVA Consulting LLC -1

- Task 2 from this report discussed potential sources of interference and the Consultant's analysis and conclusions
- It identifies these sources as being:
  - **Out of Band Emissions (OOBE)** – stated as an increase in the effective noise floor which might 'drown out' the desired signal
  - **Receiver Blocking** – stated as excessive on-channel signal levels overloading the receiver
  - **Intermodulation (IM)** – stated as the undesired combining of several signals in a nonlinear device producing new unwanted signals
- This review will focus on OOBE - as we consider this type of interference to be potentially most harmful to Sensus systems and the most likely of the three interference sources to occur in practical deployments
- The Consultant's report comments on the Real Wireless OOBE analysis reviewing each parameter for which Real Wireless had set out a rationale as to why the PDV proposed values were not appropriate – below we comment on the significant changes suggested by the Consultant

Comments on report from DVA Consulting LLC - 2

- **Protection Level** dBm/Hz: PDV: -160 / Real Wireless: -170 to -168 (Real Wireless offered two scenarios – Challenging Case and Moderate Case) / Consultant: -162
  The Consultant cites two documents for the receiver sensitivity (TIA-102.CAAB and TIA-603) and one document (TSB-88) for a potential adjustment due to environmental noise
  - It appears that the Consultant has mistakenly interpreted the -116 dBm value, which in TIA-102.CAAB is stated as the "maximum RF input level for reference sensitivity" measurements, as the receiver sensitivity
  - TSB-88 Section 5.1 quotes that "it is seldom necessary to measure environmental noise in a mobile environment at frequencies higher than 400 MHz because it is rare for the total environmental noise to exceed kTB". In alignment with TSB-88, the thermal noise floor = 10xlog10(k(Joules/˚K)×T(˚K)×B(Hz)) = -174 dBm/Hz
  - FlexNet TGB receivers feature noise figure of 4 dB, thus receiver sensitivity = thermal noise floor + noise figure = -170 dBm/Hz
  - Over the past 15 years Sensus have observed this noise floor at several geographic locations with only minor excursions
- **UE Antenna Gain and Body Loss** dBi: PDV: -10 / Real Wireless: 0 to -3 / Consultant: -5.2. The Consultant cites TSB-88 as the source for this recommendation. In our opinion TSB-88 is a system design guide primarily for Land Mobile and Public Safety systems setting out guidance for achieving, inter alia, good Delivered Audio Quality rather than preventing interference from broadband systems
  - We believe the sources used by Real Wireless particularly '3GPP TR 36.942' which is an LTE co-existence study are more relevant than TSB-88 for LTE like broadband systems operating adjacent to narrowband systems
  - Body loss is entirely dependent on the way the UE is held, and on the orientation of the user with respect to the victim system. Also if the UE is not already at its maximum transmit power, the body loss will cause the transmit power to increase, negating the impact of the loss. Power control cannot be relied upon to provide protection against interference
  - We also note that PEBB will offer IoT services – potentially fixed units with external antennas – these would present lower losses than even the Real Wireless Challenging Case – potentially +10dBi

Comments on report from DVA Consulting LLC - 3

- **UE Power Back-Off** dB: PDV: 9 / Real Wireless: 0 to 3 / Consultant 5 We note that the Consultant agrees with Real Wireless that for rural environments the power back-off that corresponds to 95% of UEs is 2dB
  - The Consultant's cited reference relates to sharing studies between terrestrial LTE UE and meteorological satellites, where receivers see cumulative interference from UEs distributed over a wide area. Such statistics are irrelevant to the analysis of an individual path between a specific aggressor UE and its victim, which is the case when the PDV UE is fixed and its position could be permanently close to a FlexNet TGB
  - The Consultant assumes a "system design that prevents the UE from transmitting at full power" at handover and the Consultant quotes a reduction of 3 dB from 23 dBm; no reference source for this parameter is provided. The maximum UE transmit power is specified by the LTE standard in 3GPP 36.101 Table 6.2.2-1, which reads 23±2 dBm, and the standard does not dictate a power back-off at handover
- **LTE eNodeB Cable Loss** dB: PDV: 4 / Real Wireless: 0 or not applicable / Consultant: 4 The LTE eNodeB is neither the aggressor nor the victim in the uplink interference caused by PDV UE to FlexNet TGB and therefore the LTE eNodeB cable loss is irrelevant. We note that the Consultant did not provide a reference source for this parameter. It appears that PDV and the Consultant have mistakenly included this parameter when it is not relevant
- **Number of Simultaneously transmitting UEs:** PDV: 1 / Real Wireless 3 to 15 / Consultant 1 The Consultant refers to "a scheduling algorithm […], which reduces the occurrence of simultaneously transmitting UE in proximity of one another" and no reference source for this scheduling algorithm is provided. The LTE standard does not specify scheduling algorithms and these are vendor specific. Within the proposed 3MHz of spectrum for PEBB the LTE standard allows for 15 individually addressable 180 kHz resource blocks, in each of which the scheduler can schedule a single UE. From 3GPP Release 13 Narrowband-IoT allows for individually addressable 15 kHz subcarriers. Our original values are therefore correct

Comments on report from DVA Consulting LLC - 4

- **FlexNet Base Station Antenna Pattern:** The Consultant quotes that PDV assumed a typical 900 MHz base station antenna, BCD-87010-EDIN-1-25. The pattern data of this antenna is not available on the manufacturer's website. The most commonly used antenna in the FlexNet network is the BCD-87010-3-25 which has 3 degrees of electrical downtilt, however we note that in dense FlexNet networks 6 degrees of electrical downtilt is not uncommon
- **Propagation Model:** The propagation model chosen by the Consultant, Walfisch-Ikegami, for line-of-sight paths reverts to an empirical adjustment intended to represent the presence of scattering within an urban canyon environment.
  - It is therefore not applicable in locations represented by anything other than a street canyon, which is an environment rich in multipath and urban furniture features
  - Walfisch-Ikegami is also not applicable for base station heights above 164' (50 m); it is noted that FlexNet TGBs of Southern Company, Atmos Energy and Alliant Energy have an average height close to 164' above local ground. The free space loss model is commonly used in co-existence studies to model short and line-of-sight interference paths. We therefore recommend the use of the free space loss model at all ranges where there is potential for a line-of-sight
- **Maximum Antenna Attenuation:** We consider that the choices made by the Consultant are optimistic. Antenna patterns are measured in anechoic chambers, which exhibit no multipath propagation. In practical environments even small amounts of multipath can substantially reduce the depth of antenna pattern nulls (see example from [1]) , so these should not be relied on to provide interference protection in particular directions. The Consultant has not considered this effect. In order to deal with this it is typical to cap the attenuation from the antenna at some level, typically around 20 dB (see [2, 3])

[1] "Antenna pattern measurement technique using wideband channel profiles to Resolve Multipath Signal Components", Newhall & Rappaport, AMTA 19thsymp. Boston, Nov. 1997
[2] 3GPP TR 36.942
[3] 3GPP TR 36.814

Comments on report from DVA Consulting LLC - 5

Summary

- Overall the Consultant takes an optimistic view on many parameters and uses references that are not appropriate to the situation being examined here – broadband signals being transmitted adjacent to sensitive long range AMI systems operating in quiet spectrum
- Having reviewed each point made by the Consultant we have seen no reason to change any of the calculations and modelling we did for the critical review in 2015 and therefore no change to the implications of PEBB deployment – that extra attenuation in PDV's equipment is needed of the order of 20-30 dB – moderate case - and additional Sensus infrastructure will need to be deployed in order to overcome the increased noise level

Comments on report from Pericle Communications Company - 1

- The report examines 3 forms of interference
  - Downlink OOBE
  - Uplink OOBE
  - Receiver blocking and spectral regrowth
- The report looks at technical impacts of the band realignment, create an understanding of the technical challenges and propose mitigation methods for harmful interference
- As before this review will focus on OOBE
- The report makes several comparisons to the 800 MHz public safety re-alignment and states that interference from a single LTE carrier with no guard band (the PEBB situation) is no worse than interference from two broadband carriers with a 2 MHz guard band (the 800MHz public safety situation). We do not consider it appropriate to use a public safety voice service in the comparison – the Sensus AMI systems are long range systems designed to operate under very different performance parameters
- The report states that the PEBB system will employ the 3GPP LTE standard – Noted – previous references have been to LTE like systems
- The report analyses the interference potential to Part 90 users and Part 24 users separately – although in essence the report concludes that because it cannot carry out the same analysis for Part 24 users it states that the interference conclusions for Part 90 will apply equally to Part 24. We do not consider that such a simple comparison can be made across completely different systems which utilise different design parameters

Comments on report from Pericle Communications Company - 2

- The results from both downlink and uplink interference scenario modelling show very small areas (tiles) where interference would impact. It also shows how eNodeB base station filters can reduce the number of tiles for the downlink. The use of such a methodology does not relate to the number of smart meters that might be impacted by the PEBB service as it does not includes data on the dispersion nor density of meters
- The Part 90 OOBE analysis plots 15 mile radius circles in 3 locations – San Antonio, TX; Orlando, FL; and San Diego, CA – using real utility systems and known base station locations and for propagation employs the Anderson 2D model
- Downlink
  - eNodeB are assumed to be equipped with “a typical 10 dBd gain antenna (dbSpectra Model DS9A10F36U3D)”. The dbSpectra Model DS9A10F36U3D is an omni-directional antenna, which is not appropriate for typical sectorised LTE macrocell deployments. A typical eNodeB antenna gain from a multiband 3 sector antenna at 900 MHz is 15.4 dBd (17.5 dBi)
  - We note that the choice of antenna “dbSpectra Model DS9A10F36U3D” is pessimistic because its electrical downtilt is 0 deg. A typical value for cellular deployments is 3 deg, see 3GPP TR 36.814
  - We note that all eNodeB have been assumed to be at 36.6 m (120’) above local ground. Therefore, when assessing the interference levels additional protection is required for areas with eNodeB actual heights below 36.6 m. This is particularly necessary in Sensus’ customers like Nevada Energy, Philadelphia Electric and Southeastern Maryland Coop and in cases where mini base stations are deployed. Real Wireless recommends that the actual antenna heights should be used in such studies
  - The Consultant calculates the percentage of area within 15 mile radius where $C/(I+N)<17$ dB. We note that the Sensus endpoints are not spatially uniformly located and a disproportionate percentage of endpoints will be impacted if the aggressor eNodeB are located close to residential areas where Sensus endpoints are likely to be present

Comments on report from Pericle Communications Company - 3

- Uplink
  - We note that “broadband subscriber radios are low power (3 Watts or 1 Watt)” which corresponds to 34.8 and 30 dBm respectively
  - The Consultant assumes “a 10 dBd gain antenna at the victim” FlexNet TGB in agreement with Sensus
  - The Consultant assumes “mobile antenna gain of 3 dBd, mobile cable loss of 2 dB”; no reference source for this parameter is provided. The combined effect of gain and cable loss assumed by the Consultant is 3.14 dBi.
  - The Consultant assumes that “LTE subscriber is backed off” by 9 dB, citing [1]. We note that 9 dB corresponds to the 95% point of CSMAC WG-1 CDF curve for suburban, and that the value for rural is 2 dB. The three study tiles appear to fit to the suburban characterisation. Real Wireless has concerns if this analysis is to be used to infer protection levels due to interference in rural areas, because aggressor UEs will transmit with 7 dB increased power in such rural areas compared to the assumptions in the Consultant’s analysis. We also note that the cited reference [1] relates to sharing studies between terrestrial LTE UEs and meteorological satellites, where the satellite receiver sees cumulative interference from UEs distributed over a wide area. Such statistics are irrelevant to the analysis of PDV UEs
  - The Consultant calculates the percentage of area within 15 mile radius where $C/(I+N)<17$ dB. We note that the PDV UE may not be spatially uniformly located and local concentrations of UE will compound the interference received at FlexNet TGB, for example if UE are devices at a residential area where a FlexNet TGB is also present

[1] Commerce Spectrum Management Advisory Committee (CSMAC) Final Report: Working Group 1 – 1695-1710 MHz Meteorological-Satellite, Appendix 3: Baseline LTE Uplink Characteristics, January 22, 2013.

Comments on report from Pericle Communications Company - 4

- The same type of analysis is not able to be repeated for the Part 24 users – because the locations of the Sensus base stations are not public domain information
- The report concludes that Part 24 users must already be operating in the presence of high power Part 90 incumbents – it states that the worst case OOBE for PEBB is lower than for the incumbents and acknowledges there could be more PEBB cell sites and the average antenna height could be lower – and concludes that filtering will be required to prevent downlink interference. Part 90 users are narrowband services – the OOBE concerns are for broadband noise from an LTE system – we do not see this methodology as valid
- It concludes that interference could be mitigated by additional base station filtering, suppressed side lobe antenna patterns and co-location. The Real Wireless critical review identified the amount of additional filtering in both the base stations and UEs and suggested that co-location of TGBs and eNodeBs will help

Comments on report from Pericle Communications Company - 5

- The report also sets out a number of rule changes to accommodate PEBB including PSD limits for non rural (400W/MHz ERP) and rural areas (800W/MHz ERP) with optional higher levels up to 2000W/MHz ERP
  - PEBB control and mobile stations to be allowed 10W ERP and portable 3W ERP
  - Emission masks – fixed and mobile stations – power attenuated by at least 50+10log10(P) dB in 100KHz

Summary

- This report focuses on Part 90 users – we do not accept the simple view that the same conclusions will apply to Part 24 users
- The report fails to consider the unique requirements of the Sensus systems – AMI systems cannot be compared to land mobile radio systems
- No analysis is provided for PEBB IoT terminals which could generate higher levels of broadband noise

Conclusions

- The analysis provided in the two consultant reports that we have reviewed do not bring anything new to the discussion
- Reference to inappropriate system design documents and comparisons with voice systems fail to focus on a design to minimise interference approach
- The analysis in these reports continues to use optimistic assumptions and averages when there are large spreads of these parameters and in doing so fails to protect a significant proportion of end points which fall outside of such averages
- The content of these reports does not change the detail or conclusions set out in our 2015 critical review – it is just as appropriate today as it was then
- The mitigation measures proposed in these consultant reports to protect against OOBE go some way to meeting the additional filtering requirements identified by Real Wireless in our critical review
- There are however still a significant risks to Sensus AMI systems being highly impacted unless the full additional filtering identified by Real Wireless are employed

For details contact us at:

e info@realwireless.biz
w real-wireless.com/blog
twitter.com/real_wireless

Real Wireless Limited
PO Box 2218, Pulborough
West Sussex RH20 4XB, UK

realwireless.
independent wireless experts